Technology Adoption of Patients Record Management System for Department of Health Treatment and Rehabilitation Center Using TOE Framework

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***Abstract*—With the current administration's war against drugs, the number of patients admitted to rehabilitation and treatment centers has drastically increased. The significant increase in the number of patients also means there is an increase in the volume of data the center needs to handle. At present, the center is using pen and paper as the means of records handling. The research aimed to develop a Patient Records Management System that can be used for handling the increasing volume of data as well as the other problems experienced, such as, data redundancy and data loss. The study used qualitative research wherein qualified respondents were chosen using purposive sampling. Five groups of respondents were identified; Administrators, Admitting Officers, Social Workers, Psychologists, and Nurses. The developed Patient Record Management System was evaluated using ISO 25010 Software Quality Model by target respondents. The survey showed that the developed system was assessed as "Very Good" in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Furthermore, the respondents' degree of adoption of a Patient Records Management System reveals that they "Agree" in all terms of operational, technical, and economic considerations. This study also identified internal IT infrastructure, compatibility, human resources, organizational structure as positive adoption factors with consideration to Technology Organization Environment (TOE) framework, while financial resources, industry adoption, and jurisdictional issues impede the adoption process.**

***Index Terms*—patient records management system, treatment, rehabilitation, framework, framework, qualitative research, Philippines**

I. Introduction

Health care institutions such as hospitals, clinics and health centers deal with providing care for the life and health of their patients. These organizations have long strived to keep patients satisfied as they provide medical care. [1] Good medical care relies on well trained doctors, nurses and on high quality facilities and equipment. Good medical care also relies on accurate, comprehensive, up-to-date and accessible record keeping. Without these qualities, the medical personnel may not be able to offer the best treatment or worst, may misdiagnose the condition.

Patient record management systems in hospitals today necessitate a competent administration when handling patients, generating reports from cashier, and patient details which serves as a key factor for the flow of business transactions. [2] However, successful patient records management system also entails ensuring successful adoption and implementation.

Despite the availability of hospital management software in the market today, there is a scarcity when it comes to software intended for a rehabilitation and treatment center. Furthermore, adoption of information systems in hospitals is a complex task compared to other systems in different fields. [3] This study involves developing a Patient Records Management System that will address the problems encountered by the Department of Health Rehabilitation and Treatment Center (DOH-TRC) and covers the process of computerized record keeping starting from patient's admission to patient's evaluation for release. This study also focuses on the successful adoption of the system with respect to technological, organization and environmental factors.

A. Objectives of the Study

Based on the current research in the field of information technology, the goal of this study is to find solutions that contribute to the successful technology adoption in implementing Patient Record Management System for Department of Health Treatment and Rehabilitation Center. Using TOE framework, there is a need to investigate what capabilities successful Patient Record Management System are used, and how can these be adopted, implemented, and maintained.

Specifically, the study sought to provide solutions the following:

1. Develop a Patient Record Management System that will address the problems encountered by DOH-TRC.
2. Evaluate the developed system using ISO 25010 Quality Model in terms of its:
    a. Functional suitability

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b. Performance efficiency
c. Compatibility
d. Usability
e. Reliability
f. Security
g. Maintainability
h. Portability

3. Identify if there is a significant difference in the respondents' perceived degree of adopting a Patient Record Management System in terms of:
a. Operational
b. Technical
c. Economic

4. Identify the respondents' degree of adopting a Patient Record Management System with consideration to Technology, Organization, and Environmental aspects.

II. Research Methodology

A. Research Design

This study entitled "Technology Adoption of Patients Record Management System for Department of Health Treatment and Rehabilitation Center using TOE Framework" is a descriptive research employing qualitative approaches to assess the readiness level of respondents in the adoption of a Patients Record Management System. This descriptive study was conducted using self-administered questionnaire on three admitting officers, 124 social workers, 24 psychologists, and 29 nurses who were selected using purposive sampling. All respondents are employees of the center located at Camp Bagong Diwa, Bicutan, Taguig City.

Letters of request was sent to the center's administration for approval of conducting surveys to participating respondents. The survey is divided into three parts; evaluation of the developed system using ISO 25010 Quality Model, feasibility study, and evaluation of the respondent's perception using TOE Framework. Participant and Non-participant observation was also implemented all throughout the testing duration of the system. This method will allow the participants to listen to what each one has to say, which will give each one an opportunity to reflect on the opinions of the other respondents.

B. Research Instruments

Two experts validated the content of the questionnaire. Modifications based on relevance and clarity of the questions were done based on two experts' recommendations. After these modifications, the questionnaires together with a Letter of Consent form were submitted to the Center for Research and Development (CRD) of Adamson University for the protection of privacy and confidentiality of research information including data protection plan clearance. Questionnaires were then distributed to the different groups of respondents.

Quality parameters such as functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability and portability were measured using a 5-point scale ranging from "Excellent" (5) to "Very Poor" (1) (See Table I) while technical, operational and economic feasibility was measured using a 5-point scale ranging from "Strongly Agree" (5) to "Strongly Disagree" (1) (See Table I).

TABLE I. Likert Scale

Scale	*Range*	*Interpretation in Feasibility Study*	*Interpretation In Software Quality*
5	4.51 - 5.00	Strongly Agree	Excellent
4	3.61 - 4.50	Agree	Very Good
3	2.71 - 3.60	Neutral	Neutral
2	1.81 - 2.70	Disagree	Poor
1	1.00 - 1.80	Strongly Disagree	Very Poor

Frequency counts, percentages, and mean were used to describe the respondents and their responses statistically. F-Test under one-way ANOVA was used to determine the significant difference between the perceptions of respondents in the feasibility of adopting a Patient Records Management System as well as the significant difference of their readiness levels.

III. Results and Discussion

A. Evaluation of the Developed System Using ISO 25010 Quality Model

Table II shows the evaluation of respondents using the ISO 25010 Quality Model. All of the above indicators got an average of 4.00 which is interpreted as "Very Good".

TABLE II. Evaluation of Patient Record Management System Using ISO 25010 Quality Model

Indicators	*Mean*	*Interpretation*
Performance Efficiency	4.00	Very Good
Compatibility	4.00	Very Good
Reliability	4.00	Very Good
Usability	4.00	Very Good
Security	4.00	Very Good
Maintainability	4.00	Very Good
Portability	4.00	Very Good
Composite Mean	4.00	Very Good

These findings can be attributed to the following reasons: (1) the respondents perceived that most functions or process needed by the rehabilitation center can be accessed in the system as well as forms and documents can be generated. (2) the developed system works and executes tasks efficiently (3) the system is compatible with other programs and other processes performed by the Rehabilitation and Treatment Center (4) the system can be accessed anytime by authorized users, meets the

minimum requirements, always be available and will not have problems with lag or crashing (5) the respondents are very satisfied with how the system looks but also believe it can be improved (6) the developed system is well secured and only authorized users created by the admin can access the system. (7) the developed system can easily identify or be debugged in case of errors, and (8) This means the respondents perceived that developed system is very much portable.

B. *Respondents' Degree of Adoption of a New Patient Record Management System in terms of Operational, Technical and Economic Readiness*

1) Technical feasibility

Technical feasibility as the resources needed to develop, purchase, install, or operate the system. [4] The survey of feasibility indicators attempted to determine the technical feasibility of the proposed adoption of Patient Record Management System.

Table III shows the summary of the responses of the respondents on technical feasibility indicators in adopting a Patient Record Management System. The respondents "Agree" that adopting a Patient Record Management System is technically feasible.

TABLE III. MEAN PERCEPTION OF THE RESPONDENTS ON THE TECHNICAL FEASIBILITY IN ADOPTING A PATIENT RECORDS MANAGEMENT SYSTEM

Indicators	*Mean*	*Interpretation*
Adopting a Patients Record Management System is a practical preposition.	4.00	Very Good
The current technical resources of the organization are sufficient for adopting Patients Record Management System.	4.00	Very Good
The current technical resources can be upgraded to provide the level of technology necessary for the new system.	4.00	Very Good
Admitting Officers, Nurses, Psychologists, and Social Workers possess the necessary expertise in adopting Patients Record Management System.	4.00	Very Good
Patients Record Management System can be applied to the current problems experienced by the organization.	4.00	Very Good
A Patients Record Management System has the capacity to handle solutions.	4.00	Very Good
Composite Mean	4.00	Very Good

Table IV shows the homogeneity of variance test (F-test) on the technical feasibility in adopting a Patient Records Management System. The table reveals that there are significant differences in the perception of Administrators, Admitting Officers, Social Workers, Psychologists and Nurses in terms of the indicators pertaining to technical feasibility of adopting a Patient Records Management System. This is indicated by the computed F-value of 7.609 which is highly significant at 0.003.

TABLE IV. HOMOGENEITY OF VARIANCE TEST (F-TEST) ON THE TECHNICAL FEASIBILITY IN ADOPTING AN PATIENT RECORDS MANAGEMENT SYSTEM

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	4.51 - 5.00	2	.705	7.609	0.003
Within Groups	3.61 - 4.50	21	.093		
Total	2.71 - 3.60	23			

This further implies that differing perceptions exist among the five (5) groups of respondents with the Admitting Officers' group being the most optimistic in adopting a Patient Records Management System in terms of technical feasibility. Such is manifested by their first-hand experiences as front-liners in admitting patients for rehabilitation. Furthermore, the Admitting Officers are also in charge of the day to day operations of record keeping thereby having enough knowledge to assess the sufficiency and upgradability of present resources for the new system, thus their most optimistic view.

2) Operational feasibility

Operational feasibility means that a proposed system will be used effectively after it has been developed. [4] This part of the survey aims to get the perception of respondents with regards to the operational feasibility of adopting a Patient Record Management System. Table V shows the summary of the responses regarding the operational feasibility indicators in adopting a Patient Record Management System.

TABLE V. MEAN PERCEPTION OF THE RESPONDENTS ON THE OPERATIONAL FEASIBILITY IN ADOPTING A PATIENT RECORDS MANAGEMENT SYSTEM

Indicators	*Mean*	*Interpretation*
Patients Record Management System will maximize the use of available resources	3.93	Agree
The current work practices and procedures are suitable to support the implementation of a Patients Record Management System	4.00	Agree
A Patients Record Management System will provide suitable throughout and response time	4.20	Agree
Adopting a Patients Record Management System provide more reliable services.	4.10	Agree
Adopting a Patients Record Management System will provide solutions to the problems encountered by Admitting Officers, Nurses, Psychologists, and Social Workers.	4.26	Agree
Composite Mean	4.00	Agree

The respondents "Agree" on the feasibility of adopting a Patient Record Management System with considerations to operational factors. Table VI shows the homogeneity of variance (F-test) on the operational

feasibility in adopting a Patient Records Management System. The table reveals that there are significant differences in the perception of Administrators, Admitting Officers, Social Workers, Psychologists and Nurses in terms of the indicators pertaining to technical feasibility of adopting a Patient Records Management System. This is indicated by the computed F-value of 5.270 which is highly significant at 0.023.

TABLE VI. HOMOGENEITY OF VARIANCE TEST (F-TEST) ON THE OPERATIONAL FEASIBILITY IN ADOPTING AN PATIENT RECORDS MANAGEMENT SYSTEM

	Sum of Squares	***df***	***Mean Square***	***F***	***Sig.***
Between Groups	.533	2	.267	5.270	.023
Within Groups	.607	12	.051		
Total	1.141	14			

This further implies that differing perceptions exist among the five (5) groups of respondents with the Admitting Officers' group being the most optimistic in adopting a Patient Records Management System in terms of operational feasibility. Such is manifested by their knowledge on standard operating practices and procedures.

3) Economic feasibility

Economic Feasibility means that the projected benefits of the proposed system outweigh the estimated costs. [4] The willingness of the target Rehabilitation and Treatment Centre to adopt a Patient Record Management System is also affected by financial constraints.

TABLE VII. MEAN PERCEPTION OF THE RESPONDENTS ON THE ECONOMIC FEASIBILITY IN ADOPTING A PATIENT RECORDS MANAGEMENT SYSTEM

Indicators	***Mean***	***Interpretation***
Implementing Patients Record Management System reduces paperwork. Hence, a significant decline in cost	4.13	Agree
The Patients Record Management System saves both physicians' time and healthcare personnel time, reduces transcription costs, and leads to fewer adverse drug events with lowered associated costs, thus, healthcare personnel helps in minimizing costs	4.10	Agree
Adopting a Patients Record Management System is in line with the organization's budget	2.65	Disagree
The Patients Record Management System interfaces enhance productivity and reduce long-term cost	4.10	Agree
Composite Mean	4.00	Agree

This part of the survey attempted to determine the economic feasibility of the proposed adoption of a Patient Record Management System as perceived by the respondents. Table VII shows the summary of the responses regarding the economic feasibility indicators in adopting a Patient Record Management System.

The respondents "Agree" that adopting a Patient Record Management System is feasible in terms of economic considerations.

TABLE VIII. HOMOGENEITY OF VARIANCE TEST (F-TEST) ON THE ECONOMIC FEASIBILITY IN ADOPTING AN PATIENT RECORDS MANAGEMENT SYSTEM

	Sum of Squares	***df***	***Mean Square***	***F***	***Sig.***
Between Groups	.533	2	.267	5.270	.023
Within Groups	.607	12	.051		
Total	1.141	14			

Table VIII shows the homogeneity of variance (F-test) on the economic feasibility in adopting a Patient Records Management System. The table reveals that there are significant differences in the perception of Administrators, Admitting Officers, Social Workers, Psychologists and Nurses in terms of the indicators pertaining to economic feasibility of adopting a Patient Records Management System. This is indicated by the computed F-value of 5.270 which is highly significant at 0.023.

This further implies that differing perceptions exist among the five (5) groups of respondents with the Admitting Officers' group being the most optimistic in adopting a Patient Records Management System in terms of economic feasibility. Such is manifested by their knowledge on the availability, prices, and advantages of both storage solutions and software solutions. Furthermore, the Admitting Officers are hands-on employees in performing their daily tasks and they firmly believe that adopting a Patient Records Management System is cost-effective and will bring enough return of investment in the long run, thus, their most optimistic view.

C. Respondents' Degree of Adopting a Patient Record Management System with Consideration to Technology, Organization, and Environmental Aspects

The Technology-Organization-Environment (TOE) framework (Tornatzky *et al.*, 1990), has been used as a lens for studying IS adoption at the organizational level. [5] TOE posits that successful adoption is not just a function of appropriate technology, but suggests that factors across technological, organizational and environmental contexts influence successful IS adoption at the organizational level. [6] This part of the survey attempted to determine the degree of adoption of a Patient

Record Management System as perceived by the respondents working in the center

TABLE IX. MODEL ANALYSIS ACCORDING TO TOE FRAMEWORK FOR DOH-TREATMENT AND REHABILITATION CENTER

Factors	*Sub-Factors*	*Influence to adoption*
Technology Factors		
Internal IT infrastructure	IT infrastructure in the center is updated to suit the implementation of the Patient Records Management System	Positive
	There is a sufficient capacity of data storage.	
	IT hardware and connectivity is up-to-date.	
Compatibility	The software is compatible with IT hardware and infrastructure required for Patient Records Management System.	Positive
	Compatibility with the staff skills, talents and attitude.	
	Integration amongst different department/users is evident.	
Human Resources	A professional IT team is ready to handle and support the adoption.	Positive
	IT experts and managers are capable of increasing staff confidence in technology adoption.	
	Availability of a training plan.	
Organization Factors		
Strategy	Inclusion of Patient Records Management System as one of the keys for achieving the center's vision and mission.	Positive
	Availability of Patient Records Management System adoption plan.	
Financial Resources	There is a sufficient budget for the adoption and implementation of Patient Records Management System.	Impeding
Organizational Structure	Support for adoption from top management is present. There is an effective delegation of adoption and implementation responsibilities.	Positive
Environmental Factors		
Industry Adoption	Limited acceptance of technology adoption in different treatment and rehabilitations in the region/country.	Impeding
Jurisdictional Issues	Absence for legal framework for technology adoption across department/government agency.	Impeding

Adapted from Cloud Computing: TOE Adoption Factors By Service Model In Manufacturing, McKinnie, Michael. Retrieved from https://scholarworks.gsu.edu/bus_admin_diss/68, Georgia State University, 2016.

Table IX summarizes the technology, organization, and environmental factors based on the focus group discussion conducted with the respondents. Technology factors such as internal IT infrastructure, compatibility, and human resources were rated as positive contributory factors. Furthermore, organizational factors such as strategy and organizational structure are contributory factors to adoption, while financial resources impedes adoption. This supports the study of Nam & Pardo which states that critical factors to success include dedicated funding, leadership of top management, organizational culture, training, executive support, human resource management, and investment in technology. [7] Environmental factors such as industry adoption and jurisdictional issues also impedes adoption process. The results agree with the study of Murad & Thompson that there are four principal external environment factors that may influence decisions to adopt a new technology. These are: customers, competitors, government regulations, and economy. [8]

IV. CONCLUSION

Using the ISO 25010 Quality model as evaluation tool, results show that the system was "Very Good" in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability and portability.

The study also confirmed that the respondents' degree of adoption of a new Patient Record Management System were affirmative in all terms of operational, technical, and economic considerations. However, respondents disagreed when asked if the system is in line with the organization's budget.

The findings discussed suggest that for the successful adoption of Patient Records Management System technology factors such as internal IT infrastructure, compatibility, and human resource support must be present; organizational factors such as strategic adoption plan and support from top level management must be strong. Furthermore, financial resources and environmental factors such as technology adoption framework and making it a priority hinders technology adoption.

In line with the findings, and conclusion presented, the following recommendations are set forth. (1) Test the Patient Records Management System in the different Treatment and Rehabilitation Centers in the country. (2) Perform Current State Assessment and Gap Analysis with all stakeholders; Administrators, Admitting Officers, Nurses, Psychologists, and Social Workers before adopting the system. (3) Develop a roadmap that is aligned with the organization's strategic plan with prior focus on the budget of adopting such system.

REFERENCES

[1] *Improving Patient Experience through the Health Care Physical Environment*, Health Research & Educational Trust, Chicago, IL, March 2016.

[2] E. Emmanuel. (2009). An Automated System for Patient Record Management. [Online]. Available: http://hdl.handle.net/10570/443

[3] O. Sagiroglu and M. Ozturan. (2006). Implementation Difficulties of Hospital Information System, *Information Technology Journal*. [Online]. 5(5), pp. 892-893. Available: http://www.http://docsdrive.com/pdfs/ansinet/itj/2006/892-899.pdf
[4] G. Shelly and H. Rosenblatt, *Systems Analysis and Design*, 9th ed., Singapore: Cengage Learning Asia Pte. Ltd., 2012, pp. 81-82.
[5] L. G. Tornatzky, M. Fleischer, and A. K. Chakrabarti, *Processes of Technological Innovation*, Lexington Books, 1990.
[6] M. McKinnie, "Cloud computing: TOE adoption factors by service model in manufacturing," Dissertation, Georgia State University, 2016.
[7] T. Nam and T. A. Pardo, "Understanding municipal service integration: An exploratory study of 311 contact centers," *Journal of Urban Technology*, vol. 21, no. 1, pp. 57-78, 2014.
[8] M. Murad and J. D. Thompson, "External Environment Factors Influencing the Technology Adoption-Diffusion Decision in Malaysian Manufacturing Small Medium Enterprises (SMEs)," *Progress in Business Innovation & Technology Management*, pp. 13-22, 2011.

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